Radiolarian biostratigraphy of the Jurassic-Early Cretaceous chert-clastic sequence in the Taukha Terrane (South Sikhote-Alin, Russia)

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ABSTRACT
This paper presents the results of biostratigraphic investigations of cherty and terrigenous deposits from the Taukha Terrane. Twelve successive radiolarian assemblages which correspond to the upper Pliensbachian-lower Toarcian, lower-middle Toarcian, upper Toarcian-middle Aalenian, upper Aalenian-lower Bajocian, middle Bajocian, upper Bajocian-lower Bathonian, middle Bathonian-lower Callovian, middle Oxfordian-lower Kimmeridgian, middle-upper Kimmeridgian, lower-middle Tithonian, upper Tithonian, and lower Valanginian-lower Barremian deposits of the continuous section have been distinguished. Characteristics of the radiolarian assemblages are shortly given.

KEY WORDS
Radiolaria,
Jurassic,
Early Cretaceous,
Taukha Terrane,
Sikhote-Alin,
accretionary prism.

RÉSUMÉ
Biostratigraphie à radiolaire d'une séquence siliciclastique d'âge jurassique-crétacé inférieur dans la Taukha Terrane (sud de Sikhote-Alin, Russie).
Cet article présente les résultats d'une recherche biostratigraphique réalisée sur des dépôts siliceux et détritiques de la Taukha Terrane. Une douzaine d'assemblages consécutifs de radiolaires a pu être reconnue dans les sédiments d'une série continue où l'on peut reconnaitre le Pliensbachien supérieur-Toarcien inférieur, le Toarcien moyen inférieur, le Toarcien supérieur-Aalenien moyen, l'Aalénien supérieur-Bajocien inférieur, le Bajocien moyen, le Bajocien supérieur-Bathonien inférieur, le Bathonien moyen-Callovien inférieur, l'Oxfordien moyen-Kimmeridgien inférieur, le Kimmeridgien moyen supérieur, le Tithonique inférieur à moyen, le Tithonique supérieur et le Valanginien inférieur-Barrémien inférieur. De brèves descriptions des assemblages à radiolaires sont données.

MOTS CLÉS
Radiolaires,
Jurassique,
Crétacé inférieur,
Taukha Terrane,
Sikhote-Alin,
prisme d'accrétion.

INTRODUCTION

Cherty rocks are important in the geological structure of the South Sikhote-Alin. They comprise up to 35% of the sections of Mesozoic accretionary prisms, that are among the main structural units of the region. However, paleontology of these cherts is, in most cases, poorly studied. Cherts have been described from separate samples that allowed them to be dated accurately to a period or an epoch. The ranges of the microfaunal species in them have not been traced. Also, elementary biostratigraphic subdivision has not been constructed and therefore, comparison and correlation of the various species could not be carried out. The study of Permian chert deposits is relatively more successful, since biostratigraphic subdivisions and zonal scales have been proposed (Rudenko 1991). Some local sections of Triassic (Volokhin *et al.* 1990; Bragin 1991; Smirnova & Lepeshko 1991) and Early Jurassic cherts (Kemkin & Golozoubov 1996) have also been studied, and layers with different microfaunal assemblages have been distinguished. The younger cherty formations have not been broken down into elementary biostratigraphic subdivisions with the exception of preliminary data on Gorboushinskaya suite (Bragin 1993). Given below are the results of the microfaunal study of the most complete chert sections and overlying terrigenous deposits of the Taukha Terrane, exposed on the left bank of Roudnaya River (south-east of Dalnegorsk Town).

GEOLOGICAL SETTING OF THE REGION

The Dalnegorsk Region is situated within the Taukha Terrane (Fig. 1), an Early Cretaceous accretionary prism (Khanchuk *et al.* 1989; Golozoubov *et al.* 1992; Kemkin & Khanchuk 1993). The prism structure is a complicated combination of different-facies and different-age formations. The Taukha Terrane is composed of a repeated alternation of turbidite and olistostrome deposits constituting the matrix, and different-age accreted fragments of mostly paleoceanic, rarely paleocontinental formations. Section of the prism can be visualized as a "multi-layered cake", where relatively young deposits of the matrix alternate with more ancient accreted formations.

The accreted fragments comprise extensive (up to several tens of kilometers long) plates as well as blocks and lumps of varying sizes within the matrix of olistostrome. Both plate and matrix rocks were crumpled together into assymetric north-east trending folds with a south-east vergence. Some plates can be 500 m thick. Such a thickness is a result of the tectonic repetition (3-5 times) of some parts of accreted formations. A true thickness, for example, of cherty rocks does not exceed 100 m. The contacts between plates of the accreted fragments and the matrix (if they are not broken by later deformations) are sedimentary, distinct in lithology. Large plates usually overlie the olistostrome.

Paleoceanic accreted formations are represented by siliceous (fragments of abyssal plains) and carbonaceous (fragments of paleoguyots) facies. These facies are composed of typical bedded-cherts, dated from their different plates by Middle Carboniferous to Late Jurassic age (Rybalka 1987; Khanchuk *et al.* 1988; Bragin *et al.* 1988; Rudenko & Panasenko 1990; Volokhin *et al.* 1990; Bragin 1993), and reef-forming limestones laying on high-titanium alkaline basalts. The age of the limestone basal layers in different plates and blocks ranges from Late Devonian to Late Triassic (Nikitina 1971; Vorobeva *et al.* 1978; Bersenev 1986; Burii *et al.* 1986).

The fragments of paleocontinental formations are represented by blocks and lumps of shallow-marine (shelf) deposits containing Middle-Late Triassic macrofauna, and by plates of relatively deep-sea Permian rocks composed of sandstones and siltstones flysch alternation (Kemkin 1996).

RADIOLARIAN ASSEMBLAGES

Detailed study of cherty formations from the Taukha Terrane along the left bank of the Roudnaya River (Dalnegorsk Town area) have been carried out. The cherts and overlying turbidites of the matrix form four tectonically repeated plates (Fig. 1). The most representative

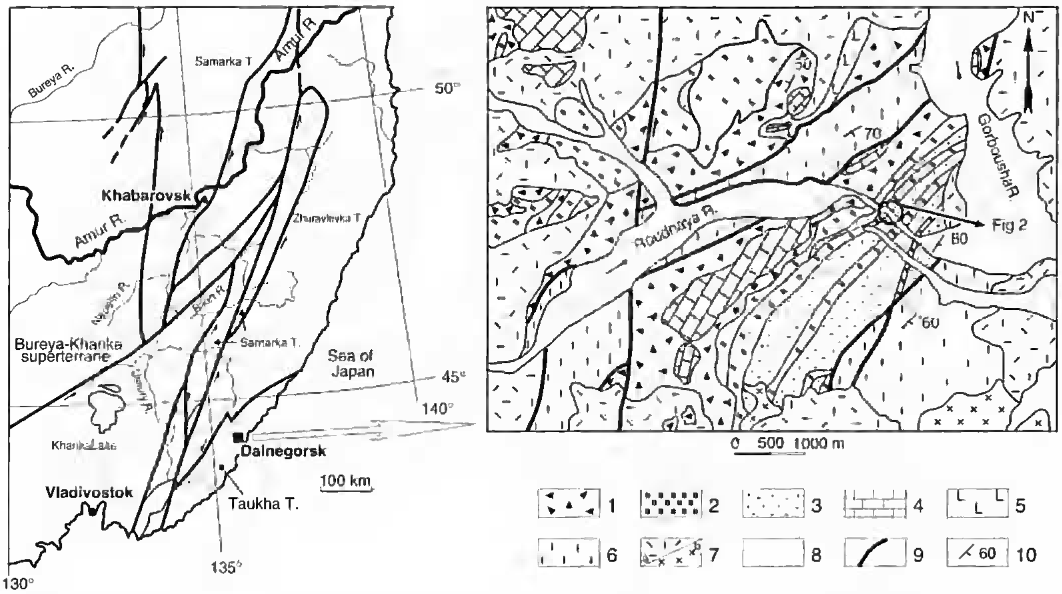


FIG. 1. — Tectonic scheme of the Sikhote-Alin Region and geological map of the investigated area. **1**, Early Cretaceous olistostrome formations of the accretionary prism matrix; **2**, plates and blocks of Triassic-Jurassic cherts; **3**, turbidite deposits of the matrix; **4**, plates and blocks of Middle-Late Triassic limestones; **5**, high-titanium alkaline basalts underlying limestones; **6**, Early Cretaceous shallow-marine (shelf) deposits; **7a**, Late Cretaceous volcanites; **7b**, intrusive formations; **8**, Quaternary deposits; **9**, dislocations with a break in continuity; **10**, elements of rock occurrence (strikes and dips).

section of the cherts was discovered in the second tectonic plate (Fig. 2) where they make up its lower portion. Within the exposure, the rocks show monoclinal dip to the southeast (dip azimuth, 130-140°, angle 70-80°). The cherts have bedded texture that is caused by thin (1-3 mm) clayey interbeds. Thickness of the chert beds varies from 1.5-2 to 3-5 cm, more rarely 7-10 cm. The rocks are broken by a series of steeply-dipping, discontinuous dislocations of northeast and submeridional trending, parallel or at angle to bedding. In the upper part of the section, the cherty formations changes to terrigenous deposits, cherry mudstones, mudstones, muddy siltstones and, then, flysch alternation of siltstones and sandstones that grade into massive sandstones. Unfortunately, the contact of cherts and terrigenous rocks at this exposure is complicated by a fault, as evidenced by the presence of boudinaged fragments of cherts in the contact part of the cherty mudstones. However, in other places (for example, Koreyskaya River area) we observe a conformable and gradual transition. The conformable and gradual transition between cherts and terrigenous deposits is very important because it indicates a smooth change of environment of sedimentation from pelagic to marginal-continental (chert accumulation is changed at the begining by the accumulation of fine and then coarse terrigenous material). This evidence fixes, thus, the moment of approach of a given part of the oceanic plate to the zone of accretion. All three Triassic and Lower Jurassic epochs have been identified in the chert units (Volokhin *et al.* 1990; Bragin 1991; Bragin 1993). According to Bragin (1993), Middle Jurassic is not represented in the section due to the essential stratigraphical break in the Middle Jurassic time. The available data on the Late Jurassic age of the cherts (Bragin 1993) are not quite correct, as the Late Jurassic Radiolaria have been separated from the cherty mudstones belonging to a transitional chert-to-terrigenous packet. The age of the terrigenous portion of the section has been determined as middle Tithonian-Valanginian (Bragin 1993). The Triassic part of the section is detaily subdivided into detailed zones by conodonts and radiolarians (Volokhin *et al.* 1990; Bragin 1991) and

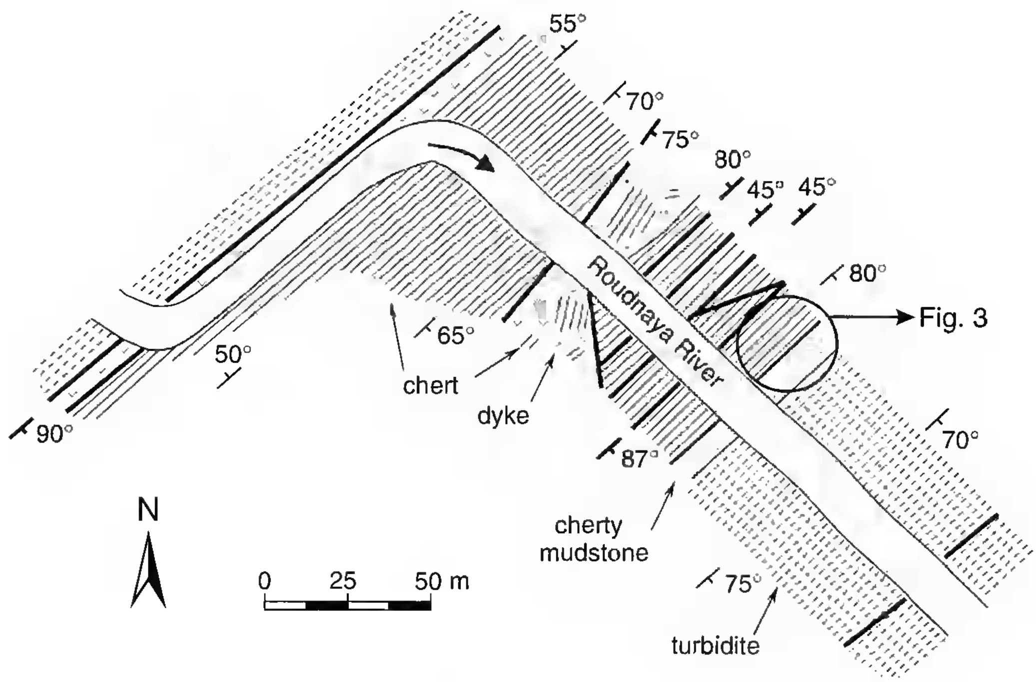


FIG. 2. — Geological scheme illustrating the structure of chert-terrigenous successions of the second tectonic plate along the Roudnaya River (Dalnegorsk Town).

is not discussed in this paper. In this study the Jurassic parts of the cherts and terrigenous rocks have been sampled in great detail. The microfaunal study shows that the cherty beds of the section contain Early, Middle and Late Jurassic radiolarians. The Late Jurassic and Early Cretaceous ones were found in terrigenous deposits (Figs 3, 5). Altogether, twelve successive radiolarian assemblages have been distinguished (Figs 3, 4). Short descriptions of these assemblages are given below in ascending order.

1. *Parahsuum longiconicum* assemblage was found in cherts of deep-grey to black in colour (samples P-21, P-20, P-19). Specific composition of the assemblage is not abundant (Fig. 3). This assemblage contains nassellarians such as *Parahsuum*, *Canoptum*, *Tricolocapsa* and *Parvicingula* and spumellarians – *Triactoma*. Age diagnostic species is *Parahsuum longiconicum*. The geological range of the assemblage is assigned to Pliensbachian-early Toarcian. The lower age boundary is assumed to be late Pliensbachian according to the first appearance of the species-index (Sashida 1988). The upper boundary is restricted by the lower one of the upward following assemblage. The assemblage is comparable in age and specific composition (Fig. 4) with the assemblage of *Parahsuum takarazawaense* zone (Sashida 1988) and subzone 4 of *Parahsuum simplum* zone (Hori 1990; Matsuoka *et al.* 1994), and lower part of *Trillus elkhornensis* zone (Matsuoka 1995) reported from Japan.

2. *Hsuum altile* assemblage was extracted from violet-deep-grey cherts (samples P-18, P-17). The assemblage characterized by a relative diversity of species (Fig. 3), with a predominance of *Parahsuum* and *Hsuum*. Some spumellarians such as *Triactoma* and others are also found here. The geological age of the assemblage is early Toarcian-middle Toarcian. Its lower boundary was defined by the appearances of *Hsuum altile*, *Hsuum transiensis*, *Parvicingula nanoconica* that have been noted since early Toarcian (Hori & Otsuka 1989; Hori 1990). The upper boundary is controlled by the upper assemblage and the last appearance of *Parahsuum longiconicum* species (Sashida 1988). Age and the specific composition of this assemblage are comparable with that of *Mesosaturnalis hexagonus* zone (Hori 1990; Matsuoka *et al.* 1994), and partially correlative with the assemblage of *Hsuum minoratum* zone (Sashida 1988) and upper parts of *Trillus elkornensis* zone (Matsuoka 1995) also reported from Japan.

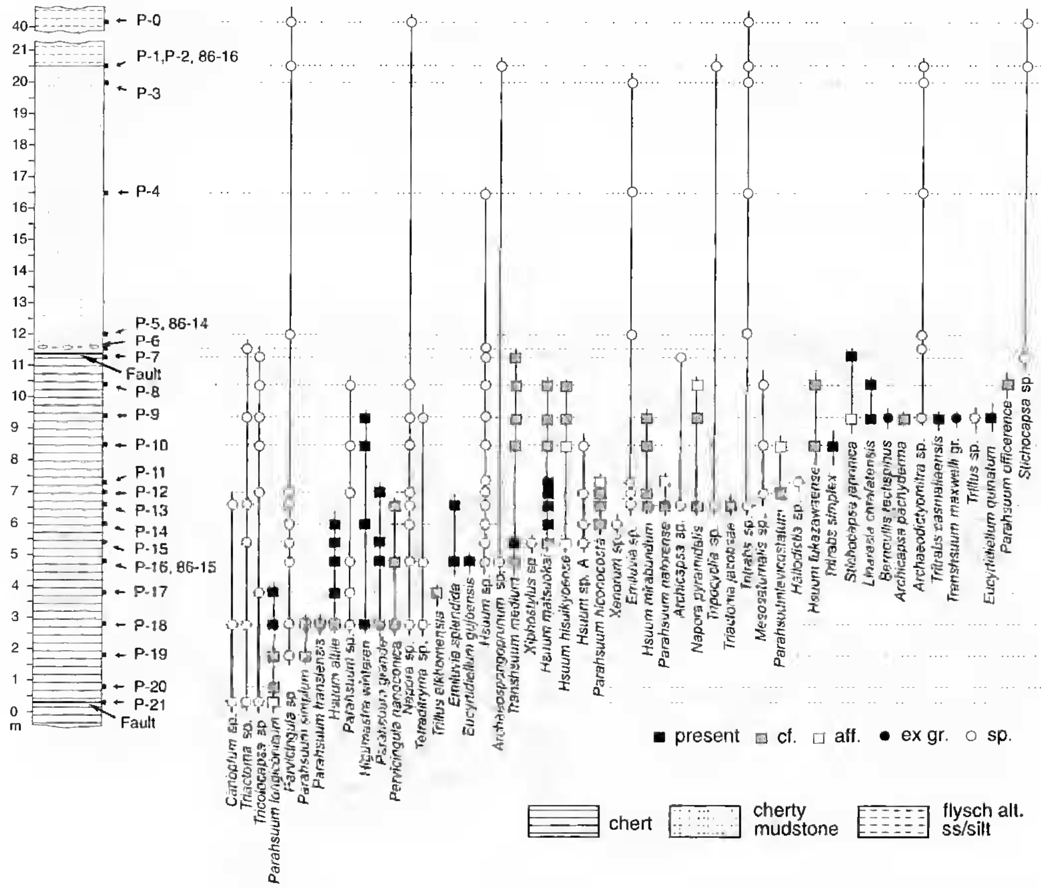
3. *Parahsuum grande* assemblage was found in the identical violet-deep-grey cherts (samples P-16, P-15, 86-15). This assemblage contains abundant and diverse representatives of nassellarians such as *Parahsuum*, *Hsuum*, and *Parvicingula*, and spumellarians such as *Emiluvia*, *Tetraditrima*, *Archaeospongoprunum*, *Xiphostilus* and others (Fig. 3). Age diagnostic species are *Parahsuum grande*, *Hsuum matsuokai* and *Hsuum hisuikyoense*. The age of the assemblage is late Toarcian-middle Aalenian. According to the first appearance of *Parahsuum grande* (Hori 1990), the older age boundary was assumed. The top is limited by the lower boundary of the upper assemblage. The assemblage is comparable with that of *Parahsuum grande* zone, and the lower portion of *Hsuum hisuikyoense* zone (Hori 1990; Matsuoka *et al.* 1994), as well as *Laxtorum jurassicum* zone (Marsuoka 1995). All zones have been identified in Japan.

4. *Parahsuum hiconocosta* assemblage was found in deep-grey cherts (sample P-14). *Parahsuum and Hsuum* predominate among the representatives that are not relarively numerous in this assemblage (Fig. 3). The geological age of the assemblage is late Aalenian-early Bajocian. The lower age boundary corresponds to the first appearance of the species-index (Baumgartner *et al.* 1995). The top is controlled by the lower boundary of the upper assemblage. The assemblage is correlated with that of the *Hsuum hisuikyoense* zone, lower part of the *Unuma echinatus* zone (Matsuoka *et al.* 1994), and upper parts of the *Laxtorum jurassicum* zone (Matsuoka 1995).

5. *Hsuum mirabundum* assemblage was extracted from blue-grey cherts (samples P-13, P-12, P-11). This assemblage shows relative specific diversity. Among the representatives, nassellarians such as *Hsuum*, *Parahsuum*, *Parvicingula* and *Tricolocapsa*, as well as spumellarians ie *Emiluvia*, *Tripocyclia* and others are prevailing (Fig. 3). The geological range of the assemblage is assumed to be early-late middle Bajocian. The lower boundary was determined by the first appearance of *Hsuum mirabundum* (Baumgartner *et al.* 1995). The upper boundary is restricted by the last appearance of such species as *Parahsuum natorense*, *Parahsuum grande*, *Emiluvia splendida*. The boundary corresponds to the end of middle Bajocian (Hori 1990; Baumgartner *et al.* 1995). This assemblage is comparable in age with that of the middle part of the *Unuma echinatus* zone (Matsuoka *et al.* 1994), and lower part of the *Tricolocapsa plicarum* zone (Matsuoka 1995) distinguished in Japan.

6. *Hsuum matsuokai* assemblage was found in light-grey cherts (samples P-10, P-9, P-8). Specific compositions of the assemblage is characterized by the essential diversiry of species. Among them, there are nassellarians: *Hsuum*, *Transhsuum*, *Parahsuum*, *Arhaeodictyomitra*, *Tricolocapsa*, and spumellarians such as *Mesosaturnalis*, *Tritrabs*, *Tetraditrima* and others (Fig. 3). Age diagnostic species are *Tritrabs casmaliaensis* and *Hsuum matsuokai*. The range of the assemblage was determined as late Bajocian-early Bathonian. The lower age boundary is based on the absence of characteristic species of the end of middle Bajocian (see assemblage 5), as well as the presence of *Tritrabs casmaliaensis* characteristic of late Bajocian (Baumgartner *et al.* 1995). The upper boundary was determined by the last appearance of *Hsuum matsuokai* that had completed its evolution in the early Bathonian (Baumgartner *et al.* 1995). This assemblage is correlated with thar of the upper parts of *Unuma echinatus* (Matsuoka *et al.* 1994) and *Tricolocapsa plicarum* (Matsuoka 1995) zones.

7. *Triactoma tithonianum* assemblage was found in greenish-grey cherts (samples P-7), 10 cm below the bottom of the cherty mudstones. *Tricolocapsa* and *Stichocapsa* predominate among the representatives that are not relatively numerous in this assemblage (Fig. 3). The geological age of the assemblage is identified as middle Bathonian-early Callovian. The lower age boundary corresponds to the upper boundary of the previous assemblage and ro the firsr appearance of *Triactoma tithonianum* (Baumgartner *et al.*



1995). The upper age boundary is restricted by the last appearance of *Transhsuum medium* (Baumgartner *et al.* 1995). The assemblage is comparable in age to that of the *Guexella nudata* (Matsuoka *et al.* 1994), and the *Tricolocapsa conexa* (Matsuoka 1995) zones.

8. *Archaeodictyomitra minoensis* assemblage was extracted from the boudinaged fragments of cherts (sample P-6) in the contact zone of cherts and cherty mudstones. This radiolarian assemblage contains mainly nassellarians and is characterized by rich specific diversity. They are *Archaeodictyomitra, Xitus, Mirifusus, Hsuum, Sethocapsa, Pseudodictyomitra, Stichocapsa* and others. The range of the assemblage is middle Oxfordian-early Kimmeridgian. Assumed lower age boundary is from the first appearance of the species-index (Baumgartner *et al.* 1995). The upper boundary corresponds to the last appearance of *Haliodicta hojnosi* (Baumgartner *et al.* 1995). The assemblage is comparable in age with that of the upper parts of the *Stylocapsa spiralis* zone (Matsuoka 1995) described in Japan. It should be noted (that within the assemblage) there are several morphological forms that are more common in Early Cretaceous radiolarians (Figs 3, 5).

9. *Pseudodictyomitra okamurai* assemblage was found in green cherty mudstones (samples P-5, 86-14). The assemblage also contains numerous and diverse radiolarian species (Fig. 3). Predominant ones are *Archaeodictyomitra* and *Pseudodictyomitra*. The range of the assemblage is middle-late Kimmeridgian. The older age boundary is somewhat tentative, but the data on the previous assemblage have been taken into account. The upper age limit is restricted by the last appearance of *Pseudodictyomitra okamurai* (Baumgartner *et al.* 1995). The assemblage is

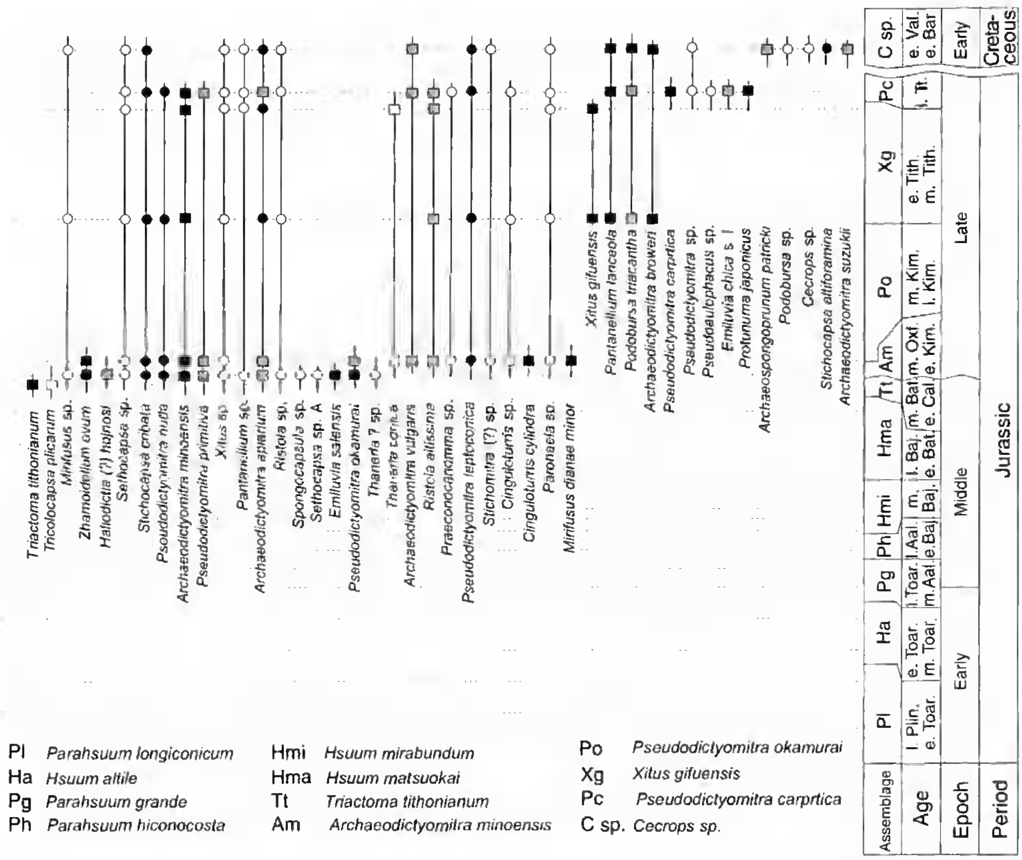


FIG. 3. — Litho- and biostratigraphical column of the Jurassic portion of the chert section and overlying cherts terrigenous deposits, enclosing radiolarian species and assemblage range along the section.

comparable in age with that of *Hsuum maxwelli* zone (Matsuoka 1995). Morphological features of some species are more common in the Early Cretaceous forms. They are ? *Pseudodictyomitra nuda* and ? *Pseudodictyomitra leptoconica* (Figs 3, 5) and also characteristic in this assemblage.

10. *Xitus gifuensis* assemblage was also found in green cherty mudstones (samples P-4, P-3). *Archaeodityomitra* and *Xitus* predominate among the numerous radiolarians of this assemblage. Some spumellarians such as *Tritrabs*, *Emiluvia* and *Pantanellium* are also found. The geological range of the assemblage is assumed as early-middle Tithonian. The lower age boundary corresponds to the first appearance of *Xitus gifuensis* (Baumgartner *et al.* 1995). The upper boundary is restricted by the lower boundary of the upper assemblage. The assemblage is correlated with that of the *Pseudodictyomitra primitiva* zone (Matsuoka 1995) and also contains some species similar to *Pseudodictyomitra nuda* and *Pseudodictyomitra leptoconica*.

11. *Pseudodictyomitra carpatica* assemblage was found in black mudstones (samples P-1, P-2, 86-16) very close to the contact with green cherty mudstones. The assemblage is represented by numerous and diverse radiolarians related to the end of Jurassic and beginning of Cretaceous time (Fig. 3). Nassellarians such as *Pseudodictyomitra*, *Archaeodictyomitra*, *Xitus*, *Thanarla*, *Sethocapsa* predominate. Spumellarians such as *Tritrabs*, *Emiluvia*, *Pantanellium* and others are also contained. The range of the assemblage is late Tithonian. The lower age boundary corresponds to the first appearance of *Pseudodictyomitra carpatica* (Matsuoka 1992). The upper boundary is

Age			Radiolarian zones and assemblages: Sashida 1988	Hori 1990	Matsuoka *et al.* 1994	Matsuoka 1995	This paper
Cretaceous	Lower	Bar				*Acanthocircus cannatus*	?
		Hau				*Cecrops septemponitus*	*Cecrops* sp.
		Val					
		Ber				*Pseudodictyomitra carpatica*	? *Pseudodictyomitra carpatica*
Jurassic	Upper	Tit				*Pseudodictyomitra primitiva*	*Xitus gifuensis*
		Kim				*Hsuum maxwelli*	*Pseudodictyomitra okamurai*
		Oxf				*Stylocapsa* (?) *spiralis*	*Archaeodictyomitra minoensis*
	Middle	Cal					?
		Bat			*Guaxalla nudata*	*Tncolocapsa conexa*	*Triaktonia tithonianum*
		Baj			*Unuma achinatus*	*Tricolocapsa plicarum*	*Hsuum matsuokai* / *Hsuum mirabundum* / *Parahsuum hiconocosta*
		Aal	*Laxtorum* (?) *jurassicum*	*Hsuum hisuikyoense*	*Hsuum hisuikyoense*	*Laxtorum* (?) *jurassicum*	*Parahsuum granda*
	Lower	Toa	*Hsuum minoratum* / *Parahsuum takarazawaense*	*Parahsuum grande* / *Mesosaturnalish exagonus* / *Parahsuum simplum* IV	*Parahsuum grande* / *Mesosatumalis hexagonus*	*Trillus elkhomensis*	*Hsuum altile* / *Parahsuum longiconicum*
		Plb	*Parahsuum simplum*	*Parahsuum simplum* III	*Parahsuum simplum*	*Parahsuum simplum*	?

FIG. 4. — Correlation table of Taukha Terrane and Japanese radiolarian zones and assemblages.

determined by the last appearance of *Archaeodictyomitra minoensis*, *Ristola altissima* and *Protunuma japonicus* (Baumgartner *et al.* 1995). This assemblage contains the species similar to *Pseudodictyomitra nuda* and *Pseudodictyomitra leptoconica*. The assemblage is comparable in age with that of the lower part of *Pseudodictyomitra carpatica* zone (Matsuoka 1995) established in Japan.

12. *Cecrops* sp. assemblage was distinguished in the black mudstones (sample P-0) that is 40 m above the horizon P-1 of the section. The assemblage is characterized by diverse and abundant radiolarian species (Fig. 3). Most of them have a wide age interval. However, the presence of *Cecrops* sp. and *Stichocapsa* ex. gr. *altiforamina* allows to determine range interval of the early Valanginian-early Barremian (Baumgartner *et al.* 1995). This assemblage is comparable in age with that of *Cecrops septemporatus* zone and lower parts of *Acanthocircus carinatus* zone (Matsuoka 1995).

CONCLUSION

We have carried out detailed biostratigraphical investigations. Twelve successive radiolarian assemblages which characterize different-age deposits of the chert-turbidite section were distinguished. Eight assemblages are included in the chert portion ranging from late Pliensbachian to early Kimmeridgian. It indicates that the chert accumulation process in Jurassic time was continuous. The presence of Middle Jurassic radiolarians (of all stages) dispute the presence of any significant stratigraphical break in Jurassic time, as was previously reported (Bragin 1993). At the same time, some chert portion, corresponding to middle Callovian-early Oxfordian time interval, as well as some of cherty mudstones is absent from the section as a result of later deformations. In the transitional packet of cherty mudstones and in the terrigenous rocks, we have established two radiolarian assemblages in each, indicating Kimmeridgian-Tithonian and late Tithonian-Early Cretaceous age of these deposits correspondingly. These data suggest that one paleogeodynamic environment of sedimentation was replaced by another at the end of Jurassic time, and that chert accretion took place in Early Cretaceous time.

Cherty formations analogous in age are known today among different accretionary prisms of the Pacific margin of Asia, from Koryak plateau

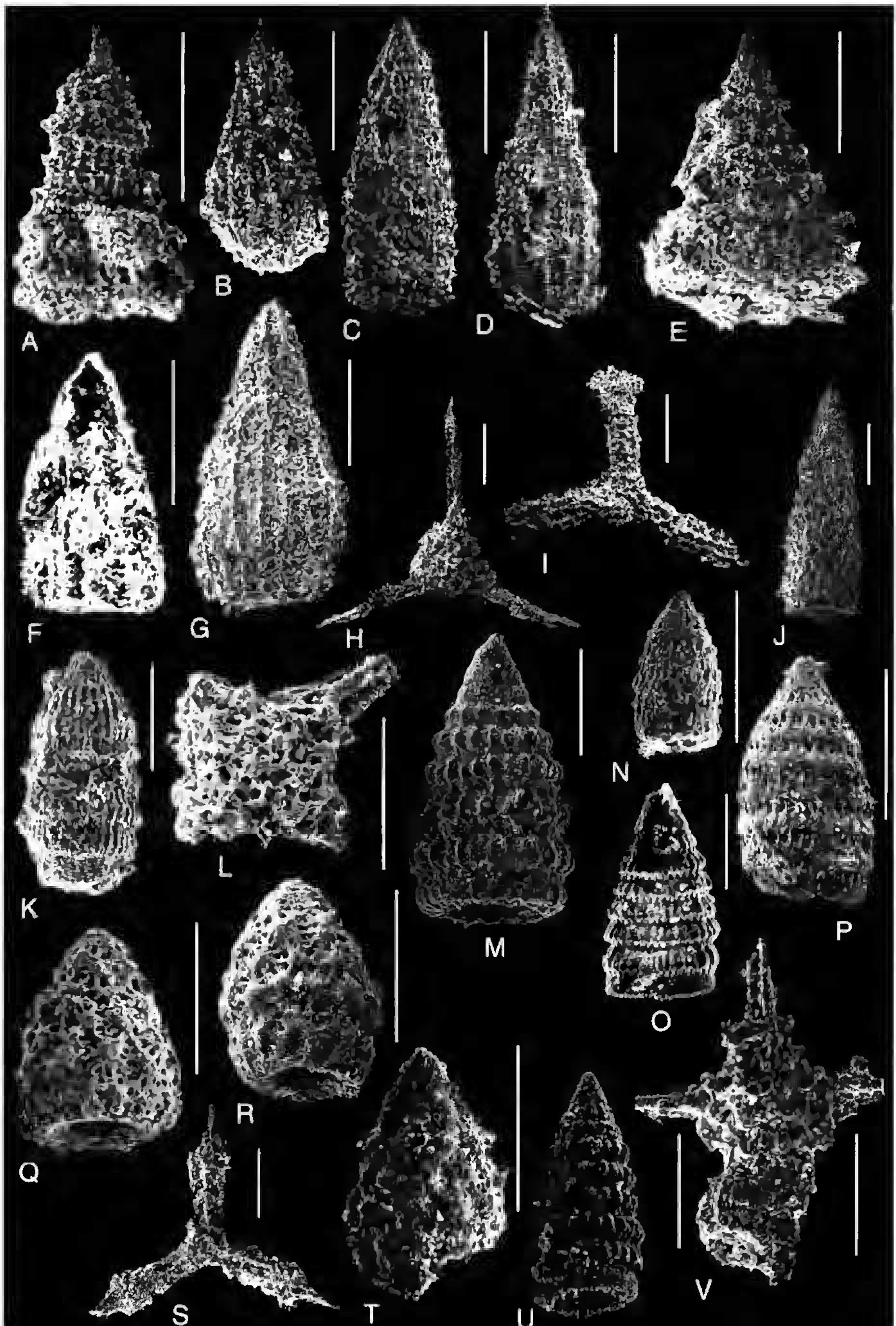


FIG. 5. — Some Jurassic and Early Cretaceous radiolarians from chert-terrigenous sequence of the Taukha Terrane. **A**, *Parahsuum* cf. *longiconicum* Sashida, P-17; **B**, *Hsuum altile* Hori & Otsuka, P-18, **C**, *Parahsuum grande* Hori & Yao, P-15; **D**, *Hsuum* sp. A, P-14; **E**, *Parahsuum* cf. *hiconocosta* Baumgartner & De Wever, P-14; **F**, *Hsuum* cf. *mirabundum* Pessagno & Whalen, P-13; **G**, *Hsuum matsuokai* Isozaki & Matsuda, P-8; **H**, *Triactoma tithonianum* Rust, P-7; **I**, *Tritrabs* cf. *casmaliaensis* (Pesagno), P-9, **J**, *Transhsuum medium* Takemura, P-8; **K**, *Archaeodictyomitra minoensis* (Mizutani), P-6; **L**, *Haliodictya* (?) cf. *hojnosi* Riedel & Sanfilippo, P-6; **M**, *Pseudodictyomitra okamurai* Mizutani, P-6; **N**, **P**, ? *Pseudodictyomitra* aff. *Nuda* Shaaf; **N**, P-6; **P**, P-4; **O**, ? *Pseudodictyomitra* aff. *Leptoconica* (Foreman), 86-14; **Q**, **R**, *Xitus gifuensis* Misutani, P-3; **S**, *Tritrabs simplex* Kito & De Wever, P-10; **T**, *Stichocapsa* ex gr. *altiforamina* Tumanda, P-0; **U**, *Pseudodictyomitra carpatica* (Lozynyak), P-2; **V**, *Cecrops* sp., P-0. Scale bars: 100 μm.

(Vishnevskaya & Filatova 1996; Kemkin *et al.* 1996 and others) to the Japanese Islands (Hori & Otsuka 1989; Hori 1990; Ichikawa *et al.* 1990; Matsuoka & Yao 1990; Mizutani *et al.* 1990; Matsuoka *et al.* 1994 and others). This fact together with data on the prism age is evidence of the existence of a single accretionary system along the western boundary of the Paleopacific in Late Jurassic-Early Cretaceous time and allows us to outline general tendencies of geological evolution of the Far East region at a given time interval.

It is interesting to note that our study has recognized among radiolarian assemblages (since Oxfordian-Kimmeridgian time) the presence of separate specimens with morphological features characteristic in Tethys area for Early Cretaceous (Valanginian and younger) forms. They are ? *Pseudodictyomitra* aff. *nuda* and ? *Pseudodictyomitra* aff. *leptonica* range intervals which, according to the currently available data (Baumgartner *et al.* 1995) are early Valanginian-Aptian and late Barremian-Aptian, correspondingly. It's likely that for different reasons, these morphological features in radiolarians of the Paleopacific area began to develop much earlier than in those of the Tethys area.

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